

Organometallic Chemistry

STRUCTURE OF THE CATALYST WHICH DEHALOGENATES PCBS

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PCBs (polychlorinated biphenyls, an important industrial chemical mixture) have been banned since 1977; however, because of their great stability, they are very long-lived in the environment. At this moment, a good way to decompose them on a large scale does not exist. One method that has been found to make them innocuous is to dechlorinate them by a Ni(II) complex which is reduced to Ni(0) by NaBH_4 or KBH_4 . The $\text{Ni(0)(PPh}_3)_4$ complex was shown to dissociate in DMF by losing one phosphine ligand to form the active catalyst (this was shown through low temperature NMR at -70°C). BH_4 was shown to have two functions in this reaction: it is the reducing agent for Ni and it provides the H to replace the Cl from the PCB. The reagent is not in the form of a nickel hydride complex when the reaction is complete; however, the real form is still not known. It has been found to be part of an equilibrium that does not resolve above -80°C . Although this reaction was previously believed to take place exclusively in DMF, it has been found to occur in HMPT as well. $\text{Ni(0)(PPh}_3)_4$, $\text{Ni(II)Cl}_2(\text{PPh}_3)_2$, and NiCl_2 were all found to be somewhat sensitive to water in both solvents. The color of each of three nickel compounds are affected by the solvent they are in. The color of Ni(II) complex is also affected by concentration. A possible explanation for this is the solvent acting as a ligand.